

**What is Claimed Is:**

1. A microinjection assembly for the delivery of exogenous nucleic acid to an avian embryo, comprising:
- an optical microscope;
- 5 a microinjection system comprising a micropipette operably connected to a micromanipulator and an oscillator; and
- an oblique macro-monitoring unit.
2. The microinjection assembly of Claim 1, wherein the optical microscope
- 10 has an incident illumination system.
3. The microinjection assembly of Claim 2, wherein the optical microscope has an objective with an optical axis, and wherein the incident illumination system is directed along the optical axis of the objective.
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4. The microinjection assembly of Claim 1, wherein the micromanipulator is programmable.
5. The microinjection assembly of Claim 1, wherein the oblique macro-
- 20 monitoring unit comprises a lens operably connected to an electronic camera and a monitor unit.

6. The microinjection assembly of Claim 1, wherein the optical microscope has a transmitted light illumination system.
7. The microinjection assembly of Claim 1, wherein the microinjection system and the oblique macro-monitoring unit are attached to the optical microscope.
8. A method for delivering exogenous nucleic acid to an avian embryo, comprising the steps of:
- (a) providing a microinjection assembly comprising an optical microscope having an objective with an optical axis, a microinjection system comprising a micropipette operably connected to a micromanipulator and an oscillator and an oblique macro-monitoring system;
  - (b) loading the micropipette with a fluid having an exogenous nucleic acid therein;
  - (c) placing an avian embryo on the optical microscope, and positioning the avian embryo in an incident light beam in the optical axis of the objective;
  - (d) positioning the micropipette by monitoring the position of the micropipette relative to the avian embryo by the oblique macro-

monitoring system;

- (e) applying an oscillation to the micropipette; and
- (f) delivering the fluid having the exogenous nucleic acid therein to a recipient avian cell in the avian embryo.

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The method of Claim 8, further comprising the steps of delivering the avian embryo to a recipient avian female; allowing the avian embryo to be laid in a hard-shell egg; and allowing the avian embryo to develop and hatch as a chick.

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- 10. The method of Claim 8, wherein the exogenous nucleic acid is an isolated nucleic acid selected from the group consisting of a plasmid, a viral vector and a linear nucleic acid, and wherein the exogenous nucleic acid is a DNA or an RNA.

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The method of Claim 8, wherein the exogenous nucleic acid is an isolated cell nucleus or an isolated spermatozoon.

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- 12. The method of Claim 8, wherein the fluid of step (b) is a physiologically acceptable fluid selected from the group consisting of physiological saline, an aqueous pH buffered fluid, and a physiologically acceptable polymer.

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The method of Claim 8, wherein the avian embryo is obtained from a bird selected from the group consisting of chicken, turkey, quail, pheasant, duck, goose, ostrich, emu and swan.

5 14. The method of Claim 13, wherein the avian embryo is obtained from a chicken egg.

15. The method of Claim 8, wherein the recipient avian cell in the avian embryo is a cytoplasm.

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16. The method of Claim 8, wherein the recipient avian cell in the avian embryo is a blastodermal cell.

17. The method of Claim 8, further comprising the step, before step (c), of:

15 surgically removing an avian ovum from a female bird before hard shell formation.

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The method of Claim 9, wherein the avian embryo is delivered to the recipient avian female by fistulation or by delivering to a surgically exposed avian infundibulum.

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